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ANNUAL ADDRESS,

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BY APPOINTMENT,

BEFORE

THE SOCIETY

FOR THE

Promotion of Useful Arts,

AT THE CAPITOL,

IN THE CITY OF ALBANY,

ON THE 3d OF FEBRUARY, 1813.

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ERRATA.

Page 15, line 11th, from the bottom, for *parts*, read *part*.

Page 17, note § for Josiah Waterman, read *Jeremiah Wilkinson*.

Page 22, line 6th, from the bottom, for *stills*, read *kettles*.

Page 24, line 2d, from the bottom, read, from analysis it appears to be quite pure.

Page 28, line 22d, Since delivering the address, I have ascertained that American *Black Lead*, is frequently used in the manufacture of Pencils. It is made a trade in this state and in Vermont. The Pencils appear to be of a good quality.

Page 39, line 15, for *natural*, read *national*.

PREFACE.

THE Address which is now presented to the public, is published as it was delivered, with a few alterations and additions, that subsequent information has enabled me to make.

In composing it, the aim proposed has been a specific one. It was to exhibit at one view the mineral riches of the United States, with their various application to the Arts, and to demonstrate the practicability of the increase of different manufactures, whose materials are derived from this source. On the policy of extensive manufactories in this country, I have not dared to touch. It is more properly the province of the politician. I may however observe, that those establishments which spring up spontaneously, without the aid of imposts and heavy duties on foreign materials, ought to be encouraged, and indeed must unavoidably flourish. It cannot however be the wish of any true patriot, that the United States should become in the strict sense of the word, a manufacturing country. The disease, vice, and diversified forms of misery, that exist in those parts of England, from whence our hardware and cloths are obtained, are sufficient to make the most sanguine advocate for the encouragement of manufactures tremble. After all that has been written and said on the subject, together with the notice that our national legislature are giving to it, the wants of the country are the true data, which must guide to a decision on this subject.

It can hardly be supposed that in noticing a subject so extensive, as the mineral kingdom, some omissions should not be made. Information is with difficulty obtained, and particularly so where the subject is new, and has not excited general attention. The errors that must necessarily be observed, will, it is hoped, be pardoned. From those, who are best acquainted with the extent and nature of the theme, I have little to fear. They are fully capable of appreciating its difficulty.

If these pages should call the attention of any of its readers to the science of mineralogy, and cause them to lend their exertions to promote its usefulness, the highest wish of the Author will be gratified.

ANNUAL ADDRESS.

IT is of vast importance to a country, that knowledge be extensively diffused. Its utility is not confined to individuals, whose minds may be enlightened, and whose feelings may be improved; but is spread over every part of community. Taken in its most comprehensive sense, it may justly be asserted, that knowledge advances civilization, gives new energy to the mental powers, and places man in that proud and commanding station in the scale of animated being to which his destiny entitles him. The maxim that "*knowledge is power*," is daily elucidated in the affairs of life; and among the moral phœnomena that agitate the world, its effects are clearly perceptible. It resembles in this respect, the electric fluid, which during the calm and tranquil occurrences of nature, pervades and operates imperceptibly over space, but when collected in the heavens, and kindled into action, its effects are tremendous and overpowering. Like all other things, it may be abused. The advantage that its owner possesses, may be employed towards the demoralizing of society, or the destruction of the species. But to those who are unwilling, or incapable of appreciating its importance in so grand a point of view, it may be sufficient to

refer to the improvements daily produced in domestic comforts, and in the enjoyments of social life. "We are," says an elegant writer, "much happier for the discovery of "Barometers, Thermometers, Steam Engines, and all the "innumerable inventions in the arts and sciences. We are "every day, and every hour reaping the benefit of such in-"genuity."†

Addressing myself to a society, whose aim is the promotion of useful knowledge, whose first wish is its advancement in our native country, I cannot refrain from congratulating its members on the great and important improvements, that have been made in the Arts and Sciences, since its first organization.‡ During the last twenty years, the march of investigation has been unusually rapid, elucidating something in every branch of knowledge, and improving the systems of all. Although our country, from its peculiar situation, and the pursuits of its inhabitants, has contributed but little towards this happy result, yet its effects are not the less advantageous to our citizens. The want of fortune, and leisure, prevent in a great measure the severe study necessary for inventive pursuits, still however the application of discoveries to useful and œconomical purposes, has not been wanting in many interesting, and even in some splendid instances.

The progress of discovery, and invention has peculiarly adorned the age in which we live. Amidst bloodshed and tumult, Science rises proudly pre-eminent, and claims exemption from the common lot of mortality, as well by the magnitude, as the utility of her designs. In no department has such rapid improvement been made, as in that styled *mathematical and physical science*. *Chemistry* has totally changed its form. Instead of remaining a mass of barbarous names, and crude theories, it has become a science at once stupendous and beautiful, wonderful alike for the extensive research and minute accuracy that it combines.

† Edinburgh Review, vol. 15, p. 282. Amer. edit.

‡ "The Society for the Promotion of Agriculture, Arts and Manufactures," was organized in 1791; at the expiration of its charter in 1804, it was re-incorporated under its present name, "*The Society for the Promotion of Useful Arts.*"

Within a few years, a new agent has been introduced, whose powers imagination itself could hardly have calculated. "It "has developed the composition of substances, which the "profoundest research had regarded as simple," and certainly promises at no distant day to change the whole system of chemical philosophy. The progress of *natural philosophy* has been unusually rapid. The measurement of the surface of the earth, as well as of heights, has been effected with an accuracy before unknown. The recondite properties of light and heat have been examined, and the existence of new planets ascertained. Werner and Klaproth in Germany, Kirwan in Britain, and Haüy in France, have investigated *mineralogy* and *geology* with uncommon success, and their disciples in every quarter of Europe, are pursuing these sciences with an ardour remarkable even among men, whose predominant passion is the love of knowledge. *Natural history* has not been left without its votaries. To enlarge its boundaries, numerous voyages and travels have been undertaken, the earth has been circumnavigated, the deserts of Africa have been explored by Park, and the Andes ascended by Humboldt. Through these means, the science of *medicine* has also been improved, and remedies of important value have been added from the vegetable, and mineral kingdoms.

Those *Arts* which are styled *useful*, are immediately dependant on the above branches of information, and (as might be expected) have advanced with proportionate rapidity. Among the improvements may be mentioned, the invention of machinery, the discovery and application of chemical agents, and the developement of various processes which were formerly concealed from sordid or national views.

With such a flood of light pouring on us from the old world, it surely becomes the duty of every one who desires his country's prosperity, to direct it to the best advantage. Our resources must be investigated, and our ability to conduct useful undertakings ascertained. If the establishment of manufactories is intended, it becomes a subject of preliminary enquiry, whether the number of hands required can

be properly spared by the agricultural interest, whether the materials to be used can be obtained in sufficient quantity, and whether with all the advantage that our knowledge of European inventions affords, such manufactories will prove more advantageous to the nation at large, than the importation of similar articles from foreign countries. At present they are principally required for our domestic wants. The most important to us are those which are subservient to agriculture, and without which it cannot be carried on. There are others which as an independent nation we ought to disdain procuring from abroad. Indeed a large proportion of the raw materials used in those manufactories of which we are in most need, are derived from the mineral kingdom, and if they are to be found in this country of sufficient excellence, the necessity of importation will be done away. In this point of view, the *mineralogical resources of the United States* become a subject of great interest, and are highly deserving the attention of every friend of science and the arts. A brief sketch of their value, together with their application and use in manufactures and the arts, cannot fail of receiving the attention of this society.

It is only within a few years that *mineralogy* has received the notice that it deserves. It was not indeed until this science became united with geology that it could boast of very great names among its votaries.† The magic of theoretic investigation drew many to its standard, who before attended to more pleasing branches of natural history. Werner and Hutton promulgated different systems of the formation of the earth, both probably too much influenced by the appearances that nature presents in their respective countries. The adherents of each have been numerous and active, and their exertions unwearied to establish the correctness of the different theories. In consequence of the dependence of geology on mineralogy, the latter has of course rapidly

† The various systems of the formation of the earth advanced before this period, such as Whiston's, Buffon's, &c. were *wholly* the result of hypotheses, and are totally independent of any support from mineralogy.

progressed. New discoveries are daily made, the ardour of scientific pursuit has extended to various countries, and at present it may safely be said, that no branch of learning has more numerous or ingenious disciples. When it is also recollected that chemistry forms a constituent part of the investigation, its dignity as a subject of research stands completely established.

Such is the science which in Europe has received the patronage of monarchs, and the homage of genius. In this country it is also becoming a subject of enquiry. The United States present a vast field for examination. Extending over twenty degrees of latitude, and embracing almost every climate; while the face of the country presents the various alternations of mountain and valley, and exhibits at once every formation from the primitive to the volcanic,† it cannot be doubted that at no distant day, industry and enterprize will enrich them with most of the minerals that Europe produces. It is only necessary to attend to the history of those already discovered, to be further convinced of this result.

Iron claims the highest rank both from its value and frequent use. Its application to domestic purposes is so various, and the forms in which it is used so diversified, that it is hardly possible to conceive of communities in any degree civilized, without their possessing some knowledge of its properties. The most savage nations with whose history we are acquainted, appear totally ignorant of its importance.* The existence of iron in the present United States appears to have

† Several facts proving the existence of a volcanic tract in Louisiana, are mentioned in Brackenridge's account of the minerals of that country, vide American Med. and Philos. Register, vol. 2, p. 38. Dr. Mitchill also mentions the fact with additional proofs, in his lectures on natural history.

* The arms of the aborigines of North America were principally formed from siliceous stones; those of the Fegee Islanders appear to resemble them, vide Warden's analysis of their axe stones. Med. Repos. vol. 13, p. 75. "Man" says Dr. Robertson, "was long acquainted with the other metals, before he acquired the art of fabricating iron, or attained such ingenuity as to perfect an invention, to which he is indebted for those instruments wherewith he subdues the earth, and commands all its inhabitants." History of America, book 4th.

been known at a very early period to the colonists. In the year 1620, the company to whom the province of Virginia had been granted, sent out 150 persons to erect three iron works.† The success of this attempt is not stated. In 1645, permission to make iron, was granted by the legislature of Massachusetts, and in consequence works were erected in several towns.‡ Nearly a century afterwards (in 1731) there were in New-England 6 furnaces for hollow ware and 19 forges.* In 1715, pig and bar iron were first made in Virginia. and the flourishing state of the manufactories of this metal in the colonies may be inferred from the fact, of the British Parliament in 1719, enacting several restrictive clauses unfavorable to these works.¶ Since the revolution, new mines have been continually discovered, and in general worked to great advantage. At present there is scarcely a State, in which iron is not found. From actual enumeration it appears that in 1810, the furnaces, forges and bloomeries in the United States amounted to 530, of which this state furnished 69.§ If they have increased with the same rapidity in other states as they have in ours, their number at this time cannot be much short of six hundred. The value of the iron and its manufactories annually made in the United States, is estimated by Mr. Gallatin at from 12 to 15 millions of dollars,‖ whilst the imported metal, in its forms of bar-iron, steel, &c. is supposed to average near four millions. This statement is highly encouraging even if it be compared with the English iron trade. Abounding in mines of excellent ore, and in facilities for working them, it is still found that for seven years (from 1797 to 1803) England annually imported about

† Holmes' American Annals, vol. 1, p. 205.
‡ Ibid. - - vol. 1, p. 335.
* Ibid. - - vol. 2, p. 130.
¶ Oddy's European Commerce, vol. 2, p. 286.
§ Mitchell's view of the manufactures in the United States, in the American Med. and Philos. Register, vol. 2, p. 413.
‖ Gallatin's report on the state of American manufactures in 1810. The manufactures of iron in the state of Pennsylvania amounted in that year to the value of $5,869,487. (Mease's Picture of Philadelphia, p. 80.)

43,000 tons of iron.† The value indeed of her manufactories consist principally in labor. The exquisite state of workmanship to which the various forms of iron are brought, and the extent of her commerce, places it among the most productive branches of national industry. The metal which is used in Great Britain in the process of steel making, is procured from the district of Roslager in Sweden.‡ It is obtained from the ore, called *magnetic iron stone*, which is so pure as to yield from 80 to 90 per cent of iron. In due process of time, the nation which furnishes this rich material, is obliged to become a purchaser of the finished goods. These facts deserve the attention of the enterprising in this country. Sweden is much indebted for the high character, which her staple commodity holds in foreign markets, to the care that is bestowed in its preparation. The crown, as well as the proprietors of iron works, interest themselves in preserving its reputation.* A subject so intimately connected with domestic improvements, certainly deserves the fostering care of government.

The ores of iron which are found in this country, are for the most parts, *magnetic iron stone*, *brown hæmatite*, *and bog iron ore*.§ The *sparry iron stone* has also been discovered and used. These different kinds are among the most valuable species of the mineral. They all yield an abundant per centage of ore, so as in most cases to bring a handsome profit to the proprietors. Several local circumstances conduce to this end. The cheapness of charcoal, the almost inexhaustible supply that our forests promise, the beds of coal that are continually discovering, are all arguments in favor of our nurturing this domestic manufacture. The only deficiency appears to originate from the want of work-

† Oddy's European Commerce, vol. 2, p. 290.

‡ Jameson's Mineralogy, vol. 2, p. 273. Chaptal calls it Rosalgia.

* Jameson's Mineralogy, vol. 2, p. 271. The various regulations adopted by the crown and the iron masters are noticed by Oddy, and also in Portia's travels in Sweden. Vide Pinkerton's Collection of Voyages and Travels, vol. 6th.

§ In noticing various minerals, I have adopted the names, and in general the arrangement, used by Jameson in his system of oryctognosie.

men who are sufficiently intelligent, or acquainted with modern improvements. The consequence is, that the iron has not been properly prepared, and holds in our markets a comparatively small value, on account of its inferior quality.‡ A short period of time will doubtless remedy this defect. Men of capital and information are taking these establishments into their hands, and will press into their service American ingenuity and talents, together with all the aid that emigration affords.

Although foreign iron, (particularly Russia and Swedes) has in general the superiority of character in our markets, yet there are some instances in which American ranks higher than either; this is particularly the case with that manufactured at the *Ancram iron works* in this state. It is said to be superior to any now in use for iron wire, chains, &c. since it combines malleability and strength in a remarkable degree. This kind of iron sells at a higher price than either of the above.

An enumeration of what has been effected in this branch of manufactures, will evince our rapid improvement, as well as mark, what is yet to be done. Our domestic resources at this time supply us with almost every article that is needed in agricultural labors. Should it be found impracticable at any period to procure iron from foreign countries, the present works would doubtles be fully competent to meet the demand. The various implements which are necessary in husbandry, and the thousand uses to which different forms of this metal are applied on farms, together with those needed for domestic, and culinary purposes, employ much of the active industry of our citizens. Various mechanical occupations also consume a large quantity of iron. Ship building is an art in which a vast amount is used. The contrast between our situation, half a century ago, and our commercial greatness some years since, "when our thousand sails whitened every sea, and visited every shore," is a proud proof of our advancement in

‡ This fact is noticed by Mr. Gallatin in his report. Vide also Col. Gibb's notice of the Vergennes' iron works in Bruce's Mineralogical Journal, No. 2, p. 84.

naval architecture.‡ In some instances our progress is still more striking. Gen. Hamilton in his masterly report on manufactures states, that in the year 1790, there were imported into the United States 1,800,000 pounds of nails.† In 1810, (though we still imported this article in considerable quantity,) there were manufactured in this state alone, nails to nearly the same amount. The making of cut nails is claimed as an American invention*; if this be the case the nation possesses the honor, as well as the advantage of so useful an improvement. It appears to have originated in the state of Massachusetts as early as the year 1787.§

Steel is manufactured in several states|| from our own iron, where its quality will allow it to be done. From causes already mentioned, foreign metal is principally used. We are still indebted to England, and probably will be so a number of years, for our cutlery, and the finer species of hardware. The *toy shop of Europe*, as Mr. Burke styles it, must for a length of time furnish us with those articles that require many hands, and great labor in their construction.

It has been suggested by several distinguished chemists, and among others, by the venerable Nicholson,¶ that it would be highly advantageous, if the ore of iron could be immediately formed into steel, by expelling some of its su-

‡ Among the documents accompanying the report of the naval committee made at the present session of congress, there is an estimate of the expense of building a 74 gun ship, by Mr. Humphreys, a ship builder. The whole amount of cost is estimated at $342,700. Of this $39,100 is put down for smiths' works, anchors, &c. more than 1-9 of the whole expense.

† Page 83. Williams and Whiting's edition.

* By Gallatin, vide report.

§ In the town of Cummington, (Berkshire) they were first made from hogshead hoop. For these and several other important facts I am indebted to Mr. S. Stafford, one of the proprietors of an extensive iron furnace in this vicinity. [Since delivering the address I have been informed by Mr. Benjamin Peck, of Milton, (Saratoga county) that the credit of the invention is due to Mr. Josiah Waterman, of the town of Cumberland, in the state of Rhode-Island. It was commenced as early as the year 1776, and the first use to which they were appropriated was the making of cards—Mr. Peck is now a partner in the iron trade with the inventor's son.]

|| New-York, Pennsylvania, Massachusetts, and Delaware.

¶ Dictionary of Chemistry. Art. *Iron.*

per-abundant carbon. The method at present in vogue is tedious, and circuitous. The carbon is at first completely removed in making bar iron, and afterwards, there is a certain quantity re-incorporated in the preparation of steel. The above project certainly appears practicable, and deserves attention. There are some ores which are peculiarly suited for this experiment.

With the provisions of war which are formed from iron, this country is abundantly supplied. At several establishments, cannon, together with balls and shells, are already cast, and new ones are continually erecting. Arms are manufactured by enterprizing individuals, as also at the national repositories. The founderies for heavy machinery such as is used in mills, steam boats, &c. deserve distinguished notice.

Among the various compounds of iron, there are some which deserve attention from their extensive employment in the arts. *Iron pyrites*, or sulphuret of iron, is one of these. From it the *sulphate of iron*, or copper as, an article much used in dying, is formed. It is manufactured in large quantities in the states of New-Jersey, Tennessee and Vermont.† The process by which it is obtained is so simple, that it requires but little ingenuity and care to prepare it pure. The New-Jersey copperas is by many considered superior to the imported article.*

The *chromate of iron* has been discovered by Mr. Godon in the vicinity of the city of Baltimore. By combining the chromic acid with lead, a most beautiful pigment of a yellow colour is obtained. In this form (chromate of lead) derived from the above mineral, it has several times been used by coach painters in Philadelphia and New-York, but the small quantities which are found of the chromate of

† The quantity of copperas annually manufactured in Tennessee is 56,000 lbs.—in Vermont 8000 lbs. Mitchill's View of Amer. Manufactures, in Amer. M. & P. Register, vol. 2, p. 411. By calcining copperas to a red heat, the *crocus* of commerce is formed.

* Pyrites is found in other states, besides those above enumerated, particularly in New-York and Massachusetts.

iron, and the great expense incident to its preparation, will probably prevent its extensive use.‡

Emery is said to have been lately discovered in Schoharie and Washington counties in this state. It has also been found in South Carolina. This substance is a compound of silica, alumina, and iron. Its hardness is so great, that it is used for cutting and polishing metals and precious stones.

There are several other minerals which derive some of their important qualities, from minute quantities of iron. These will be noticed hereafter.*

In the scale of importance *Copper* holds a station only inferior to iron. Its history is however not so creditable to American enterprize. It is found in the states of New-York, New-Jersey, Connecticut, Massachusetts, Virginia and South Carolina, and travellers also state that there are rich mines on the south side of Lake Superior, within the American territory. In many of these places, the ore is

‡ I have understood from Dr. Mitchill, that the prepared chromate of lead, sold at $2 per oz. He also mentions in his lectures, that a ferrugineous oxide of chrome has been discovered near Philadelphia.

* The length of the observations on iron has necessarily precluded the author from noticing some important facts. These may in some degree be condensed in a note. *Iron sand*, a species of magnetic iron stone, is said to occur in Virginia and from its purity makes excellent bar iron. (Jameson's Mineralogy, vol. 2, p. 276.) *Ochrey red iron stone*, or *red ochre*; this is probably the mineral mentioned by Dr. Williams as found in Vermont, and much used in the manufacture of nails. (History of Vermont, 2d edit. vol. 2, p. 360.) The *compact brown iron stone* is said to occur in this state. A mineral, supposed by Mr. Cutbush to be the *blue iron earth* of Werner, is found in New-Jersey. It makes a beautiful pigment. (Bruce, No. 2, p. 87.) The manufacture of *Prussian blue* ought not to pass unnoticed. It is produced by a union of the Prussic acid with iron—The former substance is the result chiefly of the decomposition of animal substances, at a high temperature. As a paint the *prussiate of iron* is highly valuable, and certainly can be made with advantage in this country. It may be proper to add, that the exertions lately made in this and adjacent states, to manufacture *iron wire*, are highly praise-worthy. Its value cannot be fully comprehended without recurring to the extent of our domestic manufactures of wool. After reviewing this article, I find that *hollow ware* is not explicitly mentioned. This is a very important and extensive branch of workmanship. The American founderies have almost destroyed the demands for European castings.

rich, yielding in some instances 75 per cent of pure metal, together with some silver, yet at present there is not a copper mine worked in the United States. Congress in 1800, authorized the President to employ an agent for the purpose of exploring the country near Lake Superior. This enterprize, which promised us an acquaintance with our mineral riches, was abandoned, before the agent had commenced his journey.† In 1719, a copper mine was discovered in New-Jersey, by Mr. Schuyler, situated between the Passaic and Hackensack, which still bears his name. The ore was found to be rich, but was shipped to England in its raw state, in consequence of the prohibitory regulations of the British government. Before the year 1731, the proprietor had exported to Bristol, about 1386 tons. The mine continued to be worked with success, until the commencement of our eventful revolution, since which period the attempts made to work it have failed.‡

Copper in its various mineral forms has been found in different parts of the country, and many elegant specimens adorn the cabinets of American mineralogists.* The copper used in the arts is however altogether imported. It is procured from Cornwall in England, and from South America, principally in the form of sheets and bolts. In this state, it is applied to many important purposes. It is used in very large quantities in ship building. Coppering vessels is found to preserve them longer from the effects of warm climates, as also from the attacks of the *Teredo Navalis*, which destroys the wood. It facilitates sailing, by presenting a smoother surface.

The various mordants, which have this metal for a basis, such as the *sulphate*, and *acetate of copper*, commonly known by the names of blue vitriol, and verdigris, are altogether obtained from foreign countries. The latter is procured from France.

† Med. Repository, vol. 6, p. 211.

‡ Latrobe's account of the Schuyler copper mine in New-Jersey. Med. Repository, vol. 6, p. 319.

* Vide the additions of the American editor to the article *copper*, in Rees's Cyclopedia, for an account of the various species of copper found in the United States.

Copper is also extensively used in combination with zinc, tin, and other metallic substances. These alloys, together with their application in manufactures, will be mentioned, after noticing the original metals.

Zinc has been discovered in the state of Pennsylvania, in the form of *sulphuret*, or *blende* as it is styled by mineralogists. It is found on the banks of Perkiomen creek, near Philadelphia.* Dr. Bruce lately analyzed an ore of this metal, brought from New-Jersey, and calls it *red oxide of zinc*. It is observed at various iron mines in that state. From the examination of that accomplished mineralogist, it appears that 76 parts out of the hundred are pure metal. He adds that it is preferable to other ores, since it forms with copper, an alloy superior in malleability and colour.†

Zinc is imported from Europe under the name of *spelter*, which is a mixture of brass and zinc, and from India under the denomination of *tutenage*, which from analysis appears to be almost pure metal.‡ From the circumstance of its malleability at a high temperature, a property lately discovered, it is probable that zinc will become an important article in manufactures. Its principle use at present, arises from its combination with copper, forming the alloy, called *brass*.

Tin is procured from England, South America and India. It is imported in the form of sheets, which is iron tinned over, or of block tin. From the first are manufactured vessels for culinary and domestic uses. This branch of industry is almost solely monopolized by the states of Connecticut and Massachusetts. It is estimated that in the former, tin plates and iron wire to the amount of $250,000, are annually used in this manufacture, and the annual value of the

* Woodhouse's analysis of the Perkiomen zinc ore, in Coxe's Medical Museum, vol. 5, p. 133. Concerning blende, professor Jameson observes, "it *sometimes*, though *extremely rarely*, is worked as an ore of zinc." This probably *sums up* the controversy between Drs. Woodhouse and Seybert, on this subject, in Coxe's Med. Museum, vols. 5 and 6.

† Bruce's M. J. No. 2, p. 96.

‡ Chaptal's Chemistry applied to the arts and manufactures, vol. 2, p. 210, Lond. edit. Vide a very curious correspondence on tutenage and spelter in the Med. Repos. vol. 15, p. 107.

tin plate works of Massachusetts, according to the enumeration of 1810, is $37,000,‡ These wares are sold throughout the union, from Louisiana to Vermont.

Tin is also used in coating articles made from iron, to remedy the inconvenience arising from the facility with which the latter metal rusts. In this form, many things are prepared, particularly such as are required in horsemanship, such as harness, stirrups, bridles, &c. Several small establishments of this nature are springing up in various parts.

The principal application of block tin, is its union with lead and antimony, forming the compound called *pewter*, from which various articles are made.*

Among the alloys of copper, a notice of those most important, as well as most commonly used in the United States, will be sufficient.

Brass is the most valuable. It is generally formed, by calcining the calamine (the ore of zinc) with charcoal, and afterwards fusing the compound with plates of copper. After refining it, the brass becomes an article of commerce, and is imported into this country, principally from Great Britain, whose mines of calamine in Derbyshire, supply a large proportion of the brass works in Europe.† This alloy is found to be infinitely more ductile than the original metals, and is in consequence drawn into wire, from which pins, scives, &c. are manufactured. In this country it is principally used in the making of stills, and other vessels. Buttons are also made in small quantities.§

The union of copper and tin forms *bell metal.* A foundery for casting bells was erected more than forty years since in Massachusetts,‖ and the business has been continued in that state ever since; in 1810, the value of those cast

‡ Morse's Geography, article *Massachusetts.*

* It is stated in Mr. Spafford's Gazetteer of the state of New-York, (now in the press,) with which I have been favored by the author, that *ores of tin* have been found in the Highlands, and in Essex and Clinton counties.

† Chaptal's Chemistry, vol. 3, p. 285.

§ The union of copper and zinc by various processes, and in different proportions, forms pinchbeck, tombal, tinsel, manheim-gold, &c.

‖ Holmes' Annals, vol. 2, p. 296.

was $8,555. Similar establishments exist in Philadelphia, and in the vicinity of this city.

Brass guns, as they are styled, are formed from a similar compound ; the zinc is generally considered a useless addition. They are cast at several founderies.

The tinning of copper vessels for domestic purposes, is a common occupation. From the deleterious properties of copper, it has been proposed to substitute zinc ; and the project certainly deserves encouragement.§

Tin is found to have a great affinity for mercury, and has in consequence been used in silvering *looking glasscs.* This trade is conducted to a considerable extent in our large cities.

Traces of several other metals have been observed throughout the United States.

Antimony has been found in the state of Connecticut, and indications of its existence are said to occur in the southern states and Louisiana. When it is recollected that in conjunction with lead, it forms *type metal*, its value appears manifest. Without it the art of printing, an art, which rescued the world from barbarism, cannot be conducted.†

A mine of *Cobalt*, combined with arsenick, has been discovered in North Carolina, and another of the same kind *(white cobalt)* exists at Chatham (Connecticut.) In its state of oxyd, this metal is used for giving various shades of blue to glass and enamel. All the *zaffre* and *smalt* (the names by which it is known in commerce) used in this business are at present made in Germany.* It is contemplated to commence a manufactory of smalt at the North Carolina mine.

Manganese in the state of black oxide, has been discovered at Ancram,‡ and several other places in this state, and *molybdena* exists in various situations. *Arsenical pyrites* are found in the district of Maine. To Mr. Hatchett we are in-

§ Various proportions of copper and tin, form bronze and speculum metal.

† Chaptal mentions that the best proportion for type metal is 80 parts of lead, and 20 of antimony. The antimony renders the compound harder, but if too much be added, it becomes brittle.

* Vide Rees' Cyclopedia, art. *cobalt*, for a detail of their manufacture ; also Nicholson's Dictionary of Chemistry.

‡ By Dr. Bruce, vide Med. Repository, vol. 11, p. 442.

debted for the analysis of *columbite*, containing a metal once supposed peculiar to this country, but which the latter investigations of Wollaston have identified with tantalum.‡ *Menachanite*, *rutile*, and *negrine*, all species of *titanium* or *menachine*, have been observed.†

In *Silver* and *Gold* we fortunately are not abundant. To our citizens indeed the discovery of a bed of gypsum, or of salt, would be of infinitely greater use than the possession of the Peruvian mines. The latter metal has however been found in Virginia on the surface of the ground, and in Cabarras county in North Carolina—In 1805 a quantity of virgin gold was brought from the latter place to the national mint, and coined into money to the amount of $11,000. It still continues to be found in creeks, and the sand bordering on them. In coinage, copper is added to the gold to give it tenacity.

The manufacture of plated ware, and jewelry, is very extensive, and valuable. Mr. Gallatin states the annual value of the first alone, in Philadelphia, at $100,000. This trade flourishes in every city on the continent.

It remains to notice a metal of great value in the arts, viz. *Lead*. It has been discovered in several of the northern and middle states.* At Perkiomen in Pennsylvania, a mine is worked, yielding an ore which produces 70 per cent of metal, together with some silver. Lead mines also exist on the Kanhawa in Virginia; but the greatest are in Louisiana, in which country it is said that the metal is found over a tract 60 miles in length, and 20 in breadth.§ From analys is, it appear to bequite pure.‖ The establishments for smelting the ore are not sufficiently matured, although

‡ Bruce No. 1. Appendix. Gov. Winthrop sent this mineral to Sir Hans Sloane, whose collection forms a part of the British Museum.

† Maclure's Observations on the Geology of the United States in the American Philosophical Transactions, vol. 6, p. 421.

* At Northampton (Mass.) vide Silliman's account of this mine (Bruce, No. 2, p. 63.) and in New-York and New-Jersey.

§ Vide Amer. M. and P. Register, vol. 2, p. 33. Also Stoddert's sketches of Louisiana.

‖ Vide Meade's Analysis of an ore from Louisiana, (Bruce's Mineral. Journ. No. 1, p. 7.)

lead to the amount of 912 tons was prepared in 1807. A few years will probably accommodate the supply to the demand. At present, the metal, together with its manufactures, and red and white lead, are imported to the amount of 2,375 tons, although the two latter articles are manufactured in considerable quantities in this country.*

Various species of lead ore have been discovered, such as the *molybdate*, (yellow lead ore) *sulphate*, (lead vitriol) and *muriate* of lead (Kidd) at Northampton,§ and the *phosphate* of lead (green lead ore) at Perkiomen,‡ but the common ore found, and indeed the only one worked as an article of commerce and manufactures, is the *sulphuret of lead* or *galena*. After roasting it to expel the sulphur, it is mixed with charcoal, and reduced in a furnace. Silver which is an important result, is obtained by cupellation; and the oxyd which remains in the form of a semivitrified mass, is stiled *litharge*, a substance used together with minium, masicot, and ceruse, (all oxides but of different colours)|| by painters, potters and glass workers.

The principal manufactures of lead are those of *shot*, and of *painter's colours*. The former are prepared by pouring the melted metal from a great height, and afterwards sorted by passing them through seives of various sized holes. The establishments for this purpose, at Philadelphia and in Louisiana, are said to yield 600 tons annually, sufficient for the late demand. It has now, since the declaration of war, increased, and thus offered a new argument for exploring and working our lead mines.

Painter's colours are prepared in several places. Besides these, lead is formed in sheets for the covering of houses, and into door and window weights, and alloyed with copper, forms what is styled *pot metal*.

Mineralogists have generally divided their kingdom into four classes. *Metals; Inflammable Fossils; Saline Sub-*

* Gallatin's Report. § By Dr. William Meade, Bruce 3, 149.
‡ By Mr. Godon (Bruce 1, 30.)
|| *Minium*, red; *massicot*, yellow; *ceruse*, white; *litharge*, reddish yellow, or orange. Minium is used in making flint glass, and for the glazing of pottery.

stances, and *Earthy Substances*. In conformity to that arrangement, having noticed the metallick substances which are found in our country, I proceed briefly to mention those belonging to the other divisions, which are native.

Coal is an article arranged under the class of *Inflammables*. This substance, which is daily becoming more valuable on account of the increasing scarcity and price of wood, has been found in various situations. It is now generally allowed, that it has a vegetable origin, but theorists differ as to its formation. The Wernerian attributes it to an aqueous process, while the Huttonian supposes heat acting under partial compression, to be the cause.† The phœnomena attending the discovery of coal in this country may probably strengthen one or the other of these hypotheses. Coal in a general way may be classed into two divisions. *Bituminous* coal, a kind which is highly inflammable, and burns with a vivid flame. This species is used for fuel, and answers the required purpose; but for various mechanical occupations, such as the smelting of iron ore, drying malt, burning of lime, and making earthen ware, coal is required that will give a strong, and steady heat, without evolving any smoke or bituminous vapour. For this purpose, the English coal, which is generally of the bituminous kind, is exposed to a great heat, and its volatile parts expelled. It is then called *Coke*. Some years since the Earl of Dundonald suggested a plan of saving these volatile products, which was adopted by him with great success.‡ The bitumen was condensed into tar, and it is said that by this method the English marine, was for several years, supplied with that important item in ship building.§ *Another species of coal* is that which is found destitute of bitumen, and in consequence is used in the arts without any previous preparation. Of this nature is the Kilkenny coal, which from analysis is

† Vide Murray's System of Chemistry, 2nd edit. vol. 3, p. 636. For some curious facts connected with this subject, vide the notice of, and extracts from the paper of Dr. Nugent, on the pitch lake of Trinidad, in Edin. Rev. No. 37, art. 9.

‡ 120 tons of coal yielded 3 1-2 tons of tar. Nicholson's Dictionary.

§ Chaptal's Chemistry, vol. 3, p. 342.

found to contain 97 parts of pure carbon out of the 100,* and the anthracite or glance coal (blind coal.) Both these kinds are found in the United States. The former exists in Virginia, on both sides of the James' river, over a tract of 15 or 20 miles. It has already become an important article in domestic commerce. The latter has been discovered in the state of Rhode-Island, in a state almost as pure as the Kilkenny coal ; † and in Pennsylvania, at Wilkesbarre, and on the Lehigh.‡ Indications of this mineral are found in the states of New-York, New-Jersey and Maryland.

In searching for coal, it is of importance that the persons engaged, should be well acquainted with the proper indications. In this country, much expense has often been unnecessarily incurred, in consequence of the ignorance of miners. An enterprise of this nature ought to be committed to a practical mineralogist, who has not only been conversant with the coal countries in England, (the rich reservoirs of this mineral,) but also understands the substances which usually form the super-incumbent strata. Much useful information may be gathered from books, particularly William's History of the Mineral Kingdom, from which an extract has been re-published in this country by Dr. Bruce.§

Should our present supply of *Sulphur* from Italy be at any period stopped, it might doubtles be obtained in sufficient quantities from the decomposition of pyrites and other metallick minerals.¶ It is said to exist in large quantities in the volcanic tract in Louisiana. Sulphur springs are found in various states. At the Clifton Springs in Ontario coun-

* Kirwan's analysis of various species of English coal, in Murray's Chemistry, vol. 3, p. 635.

† Carbon 94, ashes 6. " Vide " an enquiry into the chemical properties and character of that species of coal lately discovered in Rhode-Island, &c." Published in the 3d supp. to Barton's Med. and Physical Journal, p. 221.

‡ Strata of coal are found at Pittsburgh, and probably extend into the state of Ohio. It is also found in Tennessee, and the Indiana and Illinois Territories.

§ Bruce's M. J. No. 3, p. 166.

¶ Sulphur is obtained from pyrites in Saxony and Bohemia (Nicholson.) A cheap way of making sulphur from metallick minerals, practised at Ramelsburgh in the Hartz (Germany) is mentioned by Chaptal, vol. 2, p. 271.

ty, it appears to be a deposition from the sulphureous water, and is obtained in large quantities on the ground. In some specimens, from that place, Mr. Godon detected the sulphuric acid, in a free or uncombined state.*

Sulphur is applied to various important uses in the arts. It is an ingredient in the making of gun powder, its vapor is used in whitening wool and silk, and from it the sulphuric acid or oil of vitriol is often made. In a single establishment at Philadelphia, about 200,000 lbs. of it and other acids, are annually manufactured.†

Amber has been found in New-Jersey,‡ and *Petroleum*, under the name of *Genesee* or *Seneka Oil*, is obtained in the western district of this state. This substance in its purest forms (when it is called *Naptha*) is used in Persia, and Japan, where it abounds, for lighting streets, and several other domestic purposes.§

Mines of *plumbago*, or *black lead (graphite, carburet of iron)* are said to occur at Brimfield (Mass.) and in Virginia. It is also found in various parts of this state; although it is generally understood to be too hard and coarse for the purposes to which it is commonly applied, which is the making of pencils. The purest plumbago, and the article used in commerce, is obtained from Borrodale (Cumberland) in England. In conjunction with clay, it is used in manufacturing crucibles for the smelting of metals.

Under the denomination of *Saline Substances* is included those combinations of acids with alkalies and metals, which are found native. The salts of alumine, although an earth, are generally included.

Muriate of Soda, or common salt, deserves the first notice. This invaluable mineral is discovered in the state of rock salt, or is obtained from salt springs or sea water.‖ Of the

* Vide Medical Repository, vol. 12, p. 200.
† Gallatin's Report on American Manufactures.
‡ Bruce's Mineralogical Journal, No. 1, p. 31.
§ Jameson's Mineralogy, vol. 2, p. 47.
‖ In some instances salt is annually reproduced; as in the valley of salt from which the city of Aleppo is supplied. Vide Russel's Natural History of Aleppo, 2d edit. quarto, vol. 1, p. 55—6.

first variety, the rock salt of Cheshire,* and the salt mines of Weileicska in Poland are examples.† It sometimes forms hills; such is the case at Cordova in Spain, and in Moldavia.‡ In this country the mineral is found in a state of solution in salt springs. No traces of rock salt have yet been discovered, although it appears to be the united opinion of mineralogists that such springs communicate with, or originate from beds or strata of that substance.§ The principal places in the United States, where salt has been found are the following. In the state of New-York, in the counties of Onondaga, Cayuga, Genesee, Seneca, and Ontario. In 1800, these produced 42,754 bushels, and 1810, 543,000.‖ In Virginia and Tennessee—In Ohio, on the Scioto—In the Indiana Territory, on the Wabash.¶ In Kentucky, where 5 springs supply 36 works, which manufactured in 1810, 324,870 bushels.** Salt is also found in Louisiana. This mineral is also made from sea water by spontaneous evaporation. Works for this purpose have been established at various places on the coast. At Sagharbor, in Massachusetts,†† and in North-Carolina.‡‡ With all these resources we are still obliged annually to import three millions of bushels of salt.§§ of which more than one half was obtained from

* Vide Holland's Survey of Cheshire.

† These mines have been worked since the year 1251. They are 900 feet deep, and extend more than a league from east to west. (Jameson's Mineralogy, vol. 2, p. 15.) ‡ Ibid.

§ Kidd's Mineralogy, vol. 2, p. 9.

‖ The following is the amount made in each county, taken from Goodenow's Statistical Manual of this State, p. 9.

In Onondaga,	453,840	I am informed by Dr. Kirkpatrick,
Cayuga,	54,000	superintendent of the Onondaga Salt
Genessee,	1,400	Works, that a million of bushels of
Seneca,	25,000	Salt might be made annually at
Ontario, about	8,760	the works in the western district.
	543,000	

¶ 130,000 bushels were made in 1810, on the Wabash.

** Morse's Geography, *art.* Kentucky.

†† In Massachusetts there were 118,757 bushels made in 1810, and the works extended over 468,198 feet (Morse.)

‡‡ Works covering 275,000 feet were not long since erected there, (Gallatin.)

§§ Gallatin's letter on the importation of salt, Med. Repos. vol. 12, p. 285.

Great Britain,* and a large proportion of the remainder from Spain and Portugal. Among those various foreign kinds, the bay salt of the latter countries is preferred, for preserving meat. It is made by spontaneous evaporation from sea water.† Should our foreign importation be cut off, the demands for domestic consumption, must principally be supplied, from the sea coast. The improvement of the establishments there, ought to be effected by all possible means, and the best method of doing this, will be by a comparison of the various modes adopted in foreign countries. Those pursued in England, France, on the Mediterranean, and in the West-India Islands, may all be found in different writers on the subject.‡

Sulphate of soda, or *Glauber's salts*, is also a constituent in sea water. It is procured from it in large quantities, so much so that the waters of the Mediterranean yield it nearly in the proportion of 155 parts of their own weight.§ This substance is obtained from the mother liquor or bittern, (as it is called,) remaining after the common salt has been made. At several works on the sea coast, it is manufactured in very large quantities, so as at present to exceed the demand.‖ Soda might however be extracted from it, were not that alkali altogether supplanted by potash, in this country.

Sulphate of magnesia is obtained from mineral springs, and in this country is not unfrequently made from sea water. It is stated to have been found native, in caves in Munroe county (Virginia.)¶

* Vide " an analysis of several varieties of British and foreign " salt, with a view to explain their fitness for different commer- " cial purposes, by William Henry, M. D. F. R. S." in Mease's Archives of Useful Knowledge, vol. 2, p. 117.

† The mode of manufacturing bay salt is stated in Mease's Archives, vol. 2, p. 345.

‡ For an account of the modes pursued in England, and France, vide Chaptal's Chemistry, vol. 4, 160 et seq ; in Bavaria, vide Nicholson ; on the Mediterranean, and in the West-India Islands, vide Mease, vol. 2, p. 345.

§ Chaptal's Chemistry, vol. 4, p. 10.

‖ In 1810, 334,238 lbs. were made in Massachusetts.

¶ Coxe's Medical Museum, vol. 1, p. 95.

The nitric acid in union with potash forms another important mineral. *Salt petre*, or *Nitre*, as it is called, is observed at various places in Europe and Asia, in the form of an efflorescence, on limestone rocks and caverns,* but the article used in commerce is generally the result of artificial processes. It is usually made from the decomposition of animal and vegetable matter, formed into beds, and exposed to the action of the air. The oxygen of the atmosphere, and the azote originating from the disorganization of the materials used, unite and form nitric acid, which is combined with the potash of the beds.† This compound undergoes purification, and is then used in manufactures. Nitre was made in 1810, in several of the southern states together with Massachusetts to the amount of near half a million of pounds.‡ In the state of Kentucky, calcareous caves are found in considerable number, containing this mineral in combination with the earth. From this, it is extracted by lixiviation, and afterwards boiled to the crystalizing point. This is the mode commonly pursued both in this and in foreign countries. In France, however, at the eventful crisis of her revolution, it was found too tedious, and indeed insufficient to supply the armies with this important constituent in the making of gun powder. Purification by repeated ablutions, which carries off the deliquescent salts, was then adopted with success, and from that period to the present has been universally followed in that country.§ In one cavern alone, in Kentucky, it is calculated by Dr. Brown, that

* This is annually re-produced. The theory of its formation is stated in Murray's Chemistry, vol. 3, p. 453.

† Vide an account of the modes pursued in Prussia, Sweden, Malta, and Switzerland, for the making of nitre, in Chaptal, vol. 4, p. 128.

‡

Virginia,	59,175
Kentucky,	201,937
Massachusetts,	23,600
East Tennessee,	17,531
West Tennessee,	144,895
	447,138 lbs.

Mitchill's View, &c. A. R. vol. 2, p. 296.

§ Chaptal's Chemistry, vol. 4, p. 138.

there is one million of pounds of nitre.* Nitre is also manufactured in Virginia, and Tennessee, where it is found in limestone caves. A natural saltpetrous earth has been lately discovered in the former state, along the banks of the Potomac.†

In the making of gun powder, it is of the first importance that all the materials be perfectly pure, as well as mixed in proper proportions. Above all, it is necessary that no foreign substances be contained in the salt petre. If sulphate of soda be united with it, the compound is found to effloresce, whereas a combination with the nitrate of lime causes deliquescence. The dampness of American gun powder has already been complained of,‡ and can alone be remedied by a strict attention to the purity of the ingredients. It is extensively manufactured in several states, particularly Delaware and Maryland,§ and though it is still imported in considerable quantities, may doubtless at any period be produced in proportion to the demand.

The *sulphates of iron and copper*, when they do occur native, are generally the result of the spontaneous decomposition of iron and copper pyrites. The *sulphate of zinc* or white vitriol is made from blende.

Alum or *sulphate of alumine* may be obtained from the decomposition of pyrites, and is not unfrequently manufactured from *aluminous shale* or *schistus*, a substance found at various places in this country. Its important use is as a mordant in dying.

The *muriate of ammonia* or *sal ammoniac* is made in Philadelphia.

* Description of a cave on Crooked creek, with remarks, &c. on nitre and gun powder; by Samuel Brown, M. D. (Amer. Philos. Trans. vol. 6, p. 235.)

† Med. Repos. vol. 12, p. 296.

‡ Vide Dr. Mitchill's letter on this subject to the Secretary of the Navy, Med. Repository, vol. 6, p. 426.

§ Gallatin's Report. The mills at Brandywine makes 250,000 lbs. annually, and two near Baltimore 450,000. According to Mitchill, the gun powder mills in 1810 amounted to 207, and the quantity annually made to 1,450,000 lbs. Modes of preventing the explosion of mills are detailed in the Med. Repository, vol. 12, p. 389, and Mease's Archives, vol. 2, p. 403.

I proceed to notice a few of the minerals belonging to *Earthy Fossils*, the fourth and last class, and first of *Lime*. This substance exists in nature in various states of combination, all of which are appropriated to important purposes in the arts. No one however is used more frequently than the *carbonate*. It exists in large quantities over every part of the globe, and is often the basis of whole districts of country.* Its forms are so various, that it has received many different appellations. *Lime stone* is used principally in masonry, and is also applied in the manufacture of glass and smelting of iron ore. By calcination, the carbonic acid is expelled. Until this substance was discovered in this country, the deficiency was severely felt. In 1644, the fort on Castle Island, (Massachusetts) fell into premature decay, as it was built from lime burnt from oyster shells,† a carbonate also, but not sufficiently endowed with the property, of hardening by exposure to air, which the native mineral possesses. Lime is now found of a superior quality in the state of Rhode-Island, from which all the adjacent states are supplied. It is often met with in other parts. In its compact, hardened forms, combined with clay, silex, and often iron, it is used for building.‡ To this class is to be referred the *freestones* so frequently found in large quantities. Some species of it are apt to peel and crumble by exposure to air and water, and particularly by the operation of cold on a moist atmosphere, as is the case in England. For the building of temples to their gods, and palaces to their kings, the Egyptians used granite and porphyry, substances durable as the earth, and which will still remain, the wreck of past ages, after modern architecture shall have crumbled into ruins.§ *Marl* and *calcareous slate* also belong to this species. The one being a carbonate combined with a cer-

* Such is the case in the south of England.

† Holmes' American Annals, vol. 1, p. 331.

‡ Westminster Bridge is built of Portland stone, a species of lime stone, (Kidd, vol. 1, p. 21.)

§ Vide a paper "on the application of mineralogical and chemical science to the selection of stone for the purposes of durable architecture," by Robt. Bakewell. Mease's Archives, vol. 2, p. 157.

tain proportion of clay, so as to crumble on exposure to air, and the other, the same compound in a more hardened form. Marls are used in agriculture, principally on moist land. Pits of them exist in Orange county, and traces in various other places. The calcareous slate (lapis tegularis) is used in large quantities for the covering of houses and for flagging. It abounds in several districts. *Dolomite* or *carbonate of lime and magnesia* is not uncommon. But the most elegant variety of carbonate of lime, is *granular lime stone* or *marble*. Its colour, when pure, is perfectly white, but it is often found tinctured with various shades. Quarries of this substance are very numerous in the United States. In Vermont they extend over a large district of country, and they have been opened in most of the northern and middle states. The beauty of many of the kinds can hardly be excelled. Besides its uses in architecture, it deserves notice, as the basis of the sublime art of statuary. The marbles of our country are as pure, and indeed have almost every requisite in as great perfection, as the far famed ones of Italy. The encouragement of this branch of the fine arts ought not to be neglected. Indeed, a genius for painting and sculpture appear to be the birth right of republicans. Grecian glory still lives in her Venus De Medicis,* and Apollo Belvidere, and at the present day, American painters hold a high rank in the scale of excellence. Centuries have tried the experiment, and time has conclusively decided, that if ever a Phidias or a Praxiteles are to be rivalled, their competitors must arise in this quarter of the globe. These arts ought to be fostered, if in no other way than as merely *useful* ones. They animate genius to its best exertions, reward the soldier's deeds, and transmit to posterity an almost breathing transcript of the heroism, the virtues and the talents of their forefathers. The want of patronage is a disgrace to a free state. It stamps that republic with the seal of the basest ingratitude, who has suf-

* The Venus De Medicis, and Venus of the Capitol are of Parian marble. (Kidd.)

fered her greatest and best son to lie low in dust, "no *marble* tells us where."

Sulphuric acid and lime united form *gypsum*. From that obtained at Montmatre in the vicinity of the capital of France, the plaister of Paris used in commerce, is formed. *Sulphate of lime* is found in a state of great purity in Onondaga* and Madison counties, and on the borders of Cayuga lake. The quantities procured there are very great, and supply many parts of this and adjacent states. During the last year, it is calculated that 6000 tons have been sent into Pennsylvania from the vicinity of Cayuga lake.† It is also discovered in New-Jersey. Besides its very important use in agriculture, it is employed for the formation of stucco, and in modelling, if it be of uniform texture, and sufficiently delicate colour. Several beautiful specimens of *fibrous gypsum* have been found at Onondaga.

Fluate of lime or *fluor spar* has been noticed in New-Jersey, Connecticut, New-Hampshire,‡ and Virginia § Ornamental vases of various colours are made from it in Derbyshire, (England) where a mine is found. The acid is used in etching on glass.

Mr. Godon has observed the *phosphate of lime* in Pennsylvania.‖ In the province of Estramadura, in Spain, it forms hills, and is used in building.

Many other varieties of calcareous fossils have been noticed; they are however unimportant in the arts. I cannot however leave this subject, without noticing the *clastic marble* found in Massachusetts.¶ Beautiful specimens of this uncommon mineral are in the possession of the mineralogical committee.**

* Vide Warden's analysis of Onondaga sulphate of lime, in the Med. Repos. vol. 13, p. 76.

† This information was communicated to Simeon De Witt, Esq. by J. Geddis, one of the corresponding secretaries of the Society.

‡ Bruce, No. 1, p. 32. § Ibid, No. 2, p. 79. ‖ Ibid, No. 1, p. 30.

¶ A notice of this substance by Dr. Meade is contained in Bruce's M. J. No. 2, p. 93.

** I am informed by my friend Dr. Noyes, Prof. of Chemistry and Mineralogy at Hamilton College, that a substance resembling *chalk* in all its properties, has recently been noticed in several towns in Oneida county. It has been used instead of lime in masonry.

Magnesian fossils are quite common. Among those noticed, are the *tremolite*, *actynolite*, *chlorite* in its earthy and slaty forms, together with *talc*. *Serpentine* is found in Rhode-Island,* also at Hoboken in New-Jersey. This place is probably the richest in magnesian minerals, of any in the northern states. Beautiful specimens of *amianthus* are found, and some years since, Dr. Bruce discovered at that place, *native magnesia*, a substance altogether unknown on the eastern continent. *Asbestos* and *steatite* are frequently met with. In general it may be observed, that fossils of this class, are objects of curiosity, rather than of importance. Serpentine, steatite or soap-stone, and some others, are however used in the arts. They are occasionally turned, and polished into vessels of various shapes. At Zoblitz in Upper Saxony, there is an extensive manufactory of the latter article.†

Zircon, which was once supposed peculiar to Ceylon and Norway, has been detected at Trenton (New-Jersey) by Mr. Conrad.‡ It is used as a gem.

To the same purposes are appropriated the *emerald* and *beryl*, minerals arranged under the denomination of *Glucine* fossils, that earth forming a constituent part of their composition. Emerald is found near Boston and in Virginia.—Beryl or aqua-marine in the vicinity of Northampton (Mass.) in Maryland, and in Pennsylvania.§

Barytes has been discovered in its form of *sulphate*, in Sussex county, (New-Jersey) and in Maryland. The crystalized variety or *baroselenite* has also been observed.‖

The varieties of *Alumine* which are found in this country,

* Med. Repos. vol. 8, p. 62.

† In the returns of manufactures for Massachusetts for 1810, there is inserted the following, "Soap Stone Manufactory $13,000." From the best information I am able to obtain, the above substance appears to be a species of *potstone*, or *lapis ollaris*. It is procured from New-Hampshire, and is often used in the making of fire places, and stoves.

‡ Bruce, No. 3, p. 127.

§ Dr. Luce, a member of the mineralogical committee, has in his collection, specimens of both minerals from Massachusetts.

‖ Vide Seybert's catalogue of American minerals in Coxe's Med. Museum, vol. 5, p. 265.

are very numerous, and they form the basis of many important manufactures. *Ochres* of various colours, have been observed in several states. In these minerals, the clay is united with minute portions of iron, which gives them their various tinge of red, brown, and yellow.* These shades may be varied by the application of heat. They are employed for crayons, but are principally used as paints, in union with the dying oils, for the purpose of protecting edifices from the effects of air and rain. *Common clay* is used in the manufacture of bricks,† and *pipe clay*, which is found in Vermont, receives its name from its use. *Potter's clay* is a common production ‡ and *fuller's earth*, a species so highly valued in Great Britain in the manufacture of woollen cloth, that its exportation is forbidden by an act of parliament, is said to have been discovered in South-Carolina.§ In addition to these, may be mentioned *loam*, a compound of great importance in soils, and *felspar*, which in its decomposed state, is used in the making of porcelain. From the analysis of Mr. Cloud, an officer in the United States mint, it appears that this mineral exists at Monkton in the state of Vermont.‖ It is this substance under the name of *kaolin*, or *petunze*, from which the Chinese porcelain is made.

The several *clays* that I have noticed, are used in the mak-

* The *Terra lemnia* found in the Island of Lemnos, is a red ochre. *Brown ochre* is often called *umber*, from a place in Italy, where it is found, (Kidd.) The difference between boles and ochres, consist, in the latter containing most iron.

† 25 million were made in one year in Msssachusetts (Morse.)

‡ Clays are generally composed of silex, alumine, and oxyd of iron—*Common brick clay* contains considerable iron. *Potters clay* has generally some lime in its composition, which occasions it to vitrify on exposure to heat. *Pipe clay* on analysis, resembles *porcelain clay*, but the siliceous particles are not sufficiently fine for the latter use. The *clay* of *Limoges*, from which French porcelain is made, consists of silex, alumine, and oxyd of iron.

§ *Fuller's earth* contains a certain proportion of alumine, (not more or less than a fourth or a fifth of the whole mass) so as to render it diffusible through water. It is also necessary in order to answer its use, that the siliceous particles be very fine, else they would wear out the texture of the cloth to which they are applied, (Kidd's Mineralogy, vol. 1, p. 176.)

‖ Med. Repos. vol. 14, p. 404.

ing of earthen ware of various kinds, and also in the fabrication of articles for numerous domestic purposes. The coarser kinds of ware are made in almost every district in this country, directly on the clay used in their composition. Several establishments for the finer ones, have lately been erected, and in Vermont, an incorporated company intend to manufacture porcelain.*

Mica or *isinglass* is in general classed with aluminous fossils. Until within a few years, it was altogether used in the Russian navy as a substitute for glass. From its great elasticity it is prevented from shattering at the explosion of cannon.† It possesses another useful property; that of resisting heat, and for this reason is often employed in the construction of stoves and lanterns.

To these may be added *schistus*, and *hornblende*, substances often occurring. *Clay slate* (*argillite* of Kirwan,) is the variety used for writing. *Whet slate* or *honestone* (*Novaculite*) also belongs to this class, and is not uncommon. The honestone of commerce is brought principally from the Levant. *Cyanite* or *sapphire* (*Disthene* of Haüy) *jasper*, and *granatite*, (*Staurotide*) have all been observed.

The last primitive earth forming a constituent in the composition of minerals, which remains to be noticed, is *Silex*. A few of the species deserve to be mentioned, such as *quartz*, *rock crystal*, and *amethyst*. *Shorl* and *tourmaline* are often found, and the *indicolite* or *tourmaline azuré* of Haüy, a rare mineral in Europe, has not long since been discovered at Goshen (Massachusetts.)‡ *Calcedony*, *zeolite*, *melanite*,§ *semi-opal*, *garnet*, *hornstone*, *woodstone*, are all native substances.‖ *Flint*, so important in war, has been ob-

* For an elaborate detail of the compositions used for *enamels* in the manufacture of Delft and Wedgewood's ware, vide Chaptal's Chemistry applied to the arts and manufactures, vol. 4, p. 242.

† Jameson's Mineralogy, vol. 1, p. 34. I have to regret my inability to avail myself of the volume of this author on *Oeconomical Mineralogy*.

‡ Bruce, No. 2, p. 123. § Bruce, No. 1, p. 31.

‖ Seybert's catalogue of American minerals, in Coxe's Med. Museum, vol. 5, p. 155.

served in New-Jersey and Pennsylvania. Numerous quarries of *burr stones* (*arid quartz* of Kirwan) have been opened in several states. They have almost superseded the demand for French burrs.

A few observations on the manufacture of glass will close this subject.

This art, considered in a mineralogical point of view, is an extremely complex one. A union of silex and the alkalies form the essential ingredients, Other substances such as salt, lime and manganese, are also used; clay of a good quality is required as the basis of glass house pots, and crucibles. These various minerals are all indispensable in the establishment of a glass house. In this country, our works are becoming of great value for the supply of natural wants. A few years since there was manufactured sufficient to meet one half of the demand, (27,000 boxes) and the remainder was imported.* This deficiency must now be supplied at home.

In enumerating the various factories, those of our own state deserve the first notice. In 1810, the annual value of their products exceeded $700,000. They amount as far as my information extends to nine; eight for the making of window glass, and one for the manufacture of bottles in Oneida county.† Of the former, two blow crown glass, and six, cylinder glass.‡ The crown glass made in this state, is generally considered equal to any in this country, and bids fair to rival, if not surpass the imported article. That made in Boston has a high character. At that place, retorts, and other articles used in chemical and pharmaceutical operations are made. Flint glass in its various forms is made at Pittsburgh (Pennsylvania.)

The materials used in the works in this state, are obtained

* Gallatin. † This business will be commenced during the ensuing summer at the Hamilton factory in our vicinity.

‡ The crown glass factories are at Deerfield (Oneida county) and at Rensselaer (Rensselaer county.) The cylinder factories are the following: one at Geneva (Ontario county;) one at Peterborough (Madison county;) one at Oneida (Oneida county;) one at Hamilton (Albany county;) one at Rensselaer (Rensselaer county;) and one at Woodstock (Ulster county.)

from various places. The clay is procured from the banks of the Delaware, near Burlington. The siliceous sand employed in the crown glass factories, is brought from Lanesborough (Mass.) In Oneida county, it is found in several places of sufficient purity for the making of cylinder glass. That used at the Hamilton factory is obtained near Port Elizabeth, (New-Jersey,) on the bank of a small river which empties into Delaware Bay. The mineral used is potash, and the colouring matter, manganese, which is preferred on account of its cheapness, to cobalt.*

I have, I fear, exhausted your patience, without doing justice to my subject. Its extensive nature will plead my excuse, for the many mistakes and omissions that doubtless have been observed.

Such is the state of American mineralogy in its infancy. Such the progress of science and the arts in that country from which two centuries ago *micaceous sand* was exported as *gold dust*.† Its manhood may proudly be anticipated, by recurring to the persevering industry, the unconquerable enterprize and the extraordinary ingenuity of our citizens.

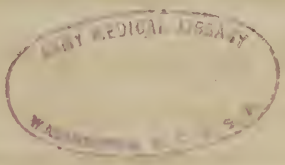
On a review of the subject, one deduction appears manifest. It is the intimate connexion that subsists between agriculture, commerce and manufactures. They are mutually dependant on each other. Conjointly, they form the pillars of the temple of society, and are in fact, the foundation of human enjoyment. Through their united effects, fishermen's huts have been transformed into emporiums of the world, nations have arisen from obscurity, and the earth has been made a fit dwelling place for the destined sons of immortality. The man who would overthrow the one, in

* For the information respecting the Hamilton and Rensselaer factories, I am indebted to Messrs. James Kane, and John Reid, of this city ; for that concerning the western establishments, to George Huntington, Esq. member of assembly from Oneida county.

† "In 1607, vessels were loaded by miners with a glittering earth dug from a bank of sand near Jamestown (Virginia) which they vainly hoped contained gold." Holmes' American Annals, vol. 1, p. 157. I have called this substance *micaceous sand*, as I am acquainted with no other mineral that answers more nearly to the above description.

order to exalt the other, is a foe to the human race. In him the heart as well as the head must be disordered.

None such are here present. We are united in one common aim of fostering and encouraging whatever may be useful to our country. The situation of *that* country is peculiarly favorable to such exertions. Our horizon though cloudy, is not enveloped in the lurid darkness of the Eastern hemisphere. In one state in Europe, every new invention which substitutes machinery for manual labor, inflames civil discord, while we hail it as a valuable addition to our national riches. In others, the Arts and Sciences are only cultivated that they may be accessary to plans of military despotism, and that contending nations may wield with fiercer destruction the infernal machinery of war. Who from this survey, where the exertions of human intellect appear cursed with unprofitableness, will not turn to his own country, as the last defence and shelter of civilization and human happiness? *Who* will not lend his best aid in conducting her to the summit of national greatness ?



APPENDIX.

Dan'l Mc—Dougall

I CANNOT permit this production to leave the press, without adding some observations on the views and objects of the Mineralogical Committee of the Society for the Promotion of Useful Arts.

This body was constituted in the winter of 1812, for the purpose of collecting and preserving such minerals as might be procured by them from this, and adjacent states, as also to analyze such as might appear new and extraordinary. The committee at present consists of the following members.

JAMES LOW, Chairman,
VINAL LUCE,
JACOB GREEN,
T. ROMEYN BECK.
BENJAMIN FORD, and
JAMES RODGERS.

A meeting is held every fortnight during the recess of the Society. Their intentions will be fully illustrated by republishing the following circular printed in 1810, by order of the Society.

" The Society for the Promotion of Useful Arts of the State of New-York, having observed that the Science of Mineralogy, which is so intimately connected with, and so eminently subservient to most of the Arts, and which has been so extensively and successfully cultivated in most other coun-

tries, is almost entirely neglected in our own state ; have endeavored to do away that imputation, by passing a resolution for collecting and preserving such specimens of Earths and Metallic Ores, as our State may afford.

In order to carry this desirable object into effect, the Society for the Promotion of Useful Arts, invite the Members of the Society as well as the lovers of the Science in every part of the State, to forward to the Recording Secretary at Albany, such specimens of Earths, Earthy Fossils, and Metallic Ores, as they may severally meet with, and request them to accompany all such specimens with as particular an account of its natural (Geological) situation as possible, and to forward with the specimens a portion of their *matrix*, or the stony or earthy substance in which they were imbedded.

The Society intend to arrange and preserve these specimens in a proper cabinet for the inspection and use of its members, and those who may have contributed to it."

By Order of the Society,

JAMES LOW, Recording Sec'ry.

March 14*th*, 1810.

Any Minerals transmitted to either of the Members of the Committee, to any of the Members of the Society resident in Albany, or to either of the Corresponding Secretaries, will receive due notice, and a particular account of its mineralogical character (if required) will be given. It is however to be understood, that at least two specimens of the same mineral must be forwarded, one for the Cabinet, and the other for the experiments that may be deemed necessary to be made on it. It is hoped that the Members of the Society, resident in different parts of the State will exert themselves to forward the wishes of the Committee.